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Acute Coronary Syndromes

METABOLOMIC PROFILE OF HUMAN MYOCARDIAL ISCHEMIA ASSESSED BY NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY OF PERIPHERAL BLOOD SERUM. A TRANSLATIONAL STUDY BASED ON TRANSIENT CORONARY OCCLUSION MODELS

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Background: Biochemical detection of myocardial ischemia (MIS) is a major challenge. Validation of novel biosignatures is of utmost importance. We sought to investigate the metabolomic profile of acute MIS using nuclear magnetic resonance (NMR) spectroscopy of peripheral blood serum of swine and patients undergoing angioplasty balloon-induced transient coronary occlusion.

Methods and Results: We applied high resolution NMR spectroscopy to profile 32 blood serum metabolites obtained (before and after controlled ischemia) from swine (n=9) and patients (n=20) undergoing transitory MIS in the setting of planned coronary angioplasty. Additionally we sequentially profiled blood serum of control patients (n=10). A preliminary clinical validation of the developed metabolomic biosignature was undertaken in patients with spontaneous acute chest pain (n=30). Striking differences were detected in the blood profile of swine and patients immediately after MIS. MIS induced an early increase (10min) of circulating glucose, lactate, glutamine, glycine, glycerol, phenylalanine, tyrosine and phosphoethanolamine, a decrease in choline-containing compounds and triacylglycerols and a change in the pattern of total, esterified and non-esterified, fatty acids. Creatine increased 2 hours after ischemia. Using multivariate analyses, we developed a biosignature that accurately detected patients with MIS both in the setting of angioplasty-related MIS (area under the curve 0.94) and in patients with acute chest pain (negative predictive value 95%).

Conclusions: This study is, to our knowledge, the first metabolic biosignature of acute MIS developed under highly controlled coronary flow restriction. Metabolic profiling of blood plasma appears as a promising approach for an early detection of MIS in patients.